Family Practice Informatics:
Research Issues
in Computerized Medical Records

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ABSTRACT

There are unique features of family and general practice which lead to unique issues in medical informatics for family physicians. The nature of practice in office based community settings and the discipline of dealing with all ages, sexes, and health conditions over the lifetime of a patient and his/her family lead to models of the thinking that are different from those used in most other specialties. Research is urgently needed to verify the models of thinking that physicians use during patient care encounters and the associated nomenclatures and classifications which support them. User interfaces need to be optimized for accuracy and speed. Standards for medical records computing in family practice need testing and validation.

INTRODUCTION

The majority of work presented at SCAMC in the last few years has focused on informatics in specialty medicine. There have been few reports of family or general practice developments. Most of the work in medical informatics in family medicine has centred on aspects of the computerized medical record.

The issues facing the informatics researcher in family/general practice records are unique and distinct from those in specialties. These are that the records:
1. are longitudinal and lifetime;
2. are done in haste, since family practice is both high skill and high volume.

3. must support a discipline that is comprehensive and community based encompassing multiple providers of care to patients who fit both the classic medical model and who fall outside it;
4. must support a discipline that deals with undifferentiated complaints in all ages, sexes and systems.

There have been a few controlled studies both in family medicine and in general specialties, which demonstrate that aspects of computerized records may improve the process of medical care.[1, 2, 3, 4, 5, 6, 7] Evidence regarding actual patient outcomes is harder to obtain since the information systems are not designed to influence patient care directly, but the results here too are encouraging.[8] The question then arises as to why only 5 % of computerized offices use the computer for more than billing. [9]

One answer is that systems development has taken place mainly in specialty settings or without the input from or regard for the unique needs of the busy office based family practitioner. These needs can be expressed in consideration of three areas which form the basis for research in medical informatics in family medicine for the future.

They are:
1. Models of how family physicians think
2. Accuracy and completeness of data which is dependent on user interfaces and vocabularies
3. Data standards

MODELS OF HOW FAMILY PHYSICIANS THINK

Computers programs for family medicine have usually been designed without the process of care taken into account. Users, (doctors and office staff) have had to adapt their ways of thinking to the function of the computer. The Ontario Family/General Practice Data Standards Project defined models of the processes of care and the required data elements to support the processes. The project authors defined as part of the emerging standards that computer record programs must be "aware" of the process of care and automatically supply required information to the provider and allow the recording of new information. What we lack are models of how family physicians think so that the computer can meld with our processes of care instead of us adapting to the machine. Although we can define the processes of care well enough we have only a flickering idea of the conceptual models of thinking used by family physicians.

One theoretical model which begs for research to validate it is the concept of a global "episode of care" which encompasses many encounters. In this model the determinants of what happens to a patient both from the health care and the economic point of view are the presenting complaint and care management plan. The presenting complaint is distinct from the diagnosis and a minor illness may present with a serious complaint and vice versa. We contend that the physician considers the reason-for-encounter as more important in determining management than the final diagnosis.

The management plan is a reflection of the process of health care. It mirrors the thinking of the physician about the potential causes and outcomes, and the most effective way to label and treat them. The actual diagnostic label is of little significance. The management plan depends on the differential diagnosis and other related health information that we already know about the patient. These other linked areas include their risk factors and family history, other intercurrent diagnoses, past presentations with the same or similar problems, and a knowledge of family dynamics and current stresses. These linkages form an entity which for lack of a better term has been called an episode of care. [10] A patient who presents with fatigue one visit, is diagnosed as having diabetes after laboratory investigation, leading to subsequent loss of sexual function and marital discord, has a common underlying linking thread to his medical life. The episode of care may comprise

many encounters, many different "diagnoses" or health problems. What delineates the fact that an episode exists are the care management processes associated with it.

We believe that physicians act in this intuitive way and that in the process of care a theoretical construct of episodes is either overtly or covertly created as the physician sees the patient. The patient is then managed in accordance with this reason-for-encounter and episode based model and not on the basis of diagnosis. We do not know whether the identification of episodes and their linkages has any intra or inter observer reliability. Different health problems or issues may be linked in different ways and we do not know how this is conceived of by individual physicians. In addition, there is no nomenclature or classification scheme to describe episodes of care for research purposes.

Cogent models of the conceptual processes of family physicians (whether "episodes" turn out to be important or not) will lead to discarding the linear algorithmic and deterministic computerization framework of the past in favour of a more complex but more naturalistic model for the practice of Family Medicine.

ACCURACY AND COMPLETENESS OF DATA

No data is useful unless it is dependable 100% of the time. Data that is 90% accurate 90% of the time will not be relied on for clinical care. The paradox is that the effort required to ensure 100% accuracy all the time is unrealistic. There is a point at which a doubling of effort produces only a minimal gain in exactitude. There is too a vicious circle. Inaccuracy leads to lack of trust in the data which leads to less reliance and use which leads to even more sloppy data entry. In addition to the limitations currently imposed on the recording and retrieval of data by hardware and software, the human factor plays a major role in determining the accuracy of medical information. Burnham [15] contends that despite the electronic information revolution, the medical record has become "less reliable than ever before".

There are several reasons for this:
1. Errors caused by physicians. According to Sackett [16] physicians agree with each other only 80% of the time with respect to history taking, physical examination, making diagnoses, interpreting X-rays and recommending treatment.
2. Laboratory and personnel errors, typographic and

transcription.
3. Misinformation from patients.
4. protection from loss of confidentiality of medical records.

How to ensure accurate and complete data is a task demanding innovation. These approaches will have to examine how we interact with the machine, both the hardware and the software, and the vocabularies we use. If user interfaces are not efficient then data will not be entered completely. If the vocabularies embedded in the records systems do not contain the terms we require to describe patients in family medicine then data will be entered which does not represent the true nature of the practice if it is input at all.

USER INTERFACES

Data entry is the biggest bottleneck to effective use of computers in family medicine. One teaching practice [13] described that the cost of data entry was prohibitive in their setting and forced the abandonment of their computerization effort. Fortunately, most offices practices are not as complex as a large teaching centre. Nevertheless, the use of the keyboard, voice and pointing devices all suffer from limitations which make their use inefficient at best. Records in family medicine are done in haste. There is no time in the process of care to input reams of data via a keyboard. Voice technology is not confidential (the patient can hear you) and pointing devices are only as good as the informational categories they point to.

There is a manifest need to develop more effective and integrated methods of data entry. Given that the computer can enhance clinical care, then there is a built in incentive for the data needed to be input accurately. Research is required to establish the best methods of entering the various data elements, how and by whom. The focus needs to be on methods of ensuring completeness, accuracy and efficiency without sacrificing naturalness. We are as yet unaware of the sources of information used by the practitioner during the course of an office visit.

VOCABULARIES

Any computer records system needs to have a defined vocabulary for critical terms in order to allow for the kinds of systematic analyses of which the computer is capable. The record can only be searched for patients with hypertension ONLY if hypertension is ALWAYS expressed in the same way, or if all terms

in local use for hypertension are related to a single "preferred term".

The limitation of using a defined vocabulary is that specificity is lost. The vocabulary does not contain the "pet" terms of individual physicians, and the physicians have trouble locating appropriate terms to describe their patients, resulting in delays in data input and an incentive to use inaccurate terms in the interest of efficiency.

No validated comprehensive vocabulary currently exists for family medicine although two new ones have recently been introduced. Read Codes [11] have been in use in the U.K. for a few years. Unified Medical Language System [12] is based on MESH headings and was not conceived with family physicians in mind or been used clinically. The International Classification of Health Problems in Primary Care (ICHPPC) has been used as a rudimentary nomenclature in our computer record and has proven a disaster. It lacks a synonym dictionary and many of the terms are arcane and not in use in our setting. Often, a health problem must be coded erroneously simply because a valid code does not exist. We have an irreducible error rate of 10% for "diagnoses". The International Classification of Primary Care (ICPC) [14] has been tried as well but it is far too non-specific for use in following patients although it is an excellent classification.

In the interim, a defined vocabulary is needed for family medicine records now. Such a vocabulary must include terms which describe the undifferentiated problems, and symptoms and complaints without diagnoses with which patients present in family medicine. Based on the recommendations of the Data Standards Project [10] our Informatics Research Group has developed such a vocabulary based on ICPC and ICD-10. This interim vocabulary as well as Read Codes and UMLS will have to be tested, and this is an urgent area of research since many current general practice systems in Europe and Australia, and some in Canada are already using ICPC with a sacrifice in specificity of problem labels.

DATA STANDARDS AND DATA MODELS

One of the reasons that computerization has been poorly accepted in family medicine is the lack of standards. There are 2 levels of standards. One is standards for software function such as backup and recovery procedures, the other is a level of

standardization to ensure technical and conceptual compatibility of information. Purchasers of systems have no idea how to evaluate the sales pitches, and have no guarantee that if they are dissatisfied, that they can switch to a different program without loss of data. In addition, there is no way to ensure that the program purchased will be able to accept laboratory data from all labs, or access data at the local hospital. As important, is the assurance that standards provide that a given system contains the correct data and fits with the processes of care in family medicine.

The need for valid standards is obvious. These have been developed, partly by the Family/General Practice Data Standards Project of Ontario [10]. This project described first a process model in which all the activities of care and their associated data used and generated were listed; and then a clinical data model in which each data element was listed, and its format and edit rules described. The models are intended, after validation to be the basis for having medical records systems which have conceptual compatibility with each other and whose data can be used to describe patterns of practice and outcomes at a micro and macro level. The models need to be tested and validated in clinical settings by family physicians.

CONCLUSIONS

Informatics issues for family physicians are distinct from those of specialists. Family practice as a high volume activity is different from many of the specialties which do not have to cope with the wide range of care both within and outside the classic medical model under the same time constraints as found in busy Family Practice offices. The vocabulary of family medicine is distinct and includes terms which reflect the unique aspects of caring for patients with health problems without diagnoses.

The conceptual models used by family physicians during patient care are unique to the environment of family medicine. Medical records are done in haste and therefore the intimate coupling of DATA to PROCESS and the user interfaces which support this coupling are critical. Data standards and system functionality standards need to be tested and promulgated.

References

[1]. Chambers CV, Balaban DJ, Carlson BL, Ungemack JA, Grasberger DM. Microcomputer Generated Reminders. Improving Compliance with Mammography Screening Guidelines. J. Fam. Pract. 1989;29:273-280.

[2]. McDowell I, Newell C, Rosser WW. A Randomized Trial of Computerized Reminders for Blood Pressure Screening in Primary Care. Med. Care 1989;27:297-305.

[3]. McDowell I, Newell C, Rosser WW. Computerized Reminders To Encourage Cervical Screening in Family Practice. J.Fam. Pract. 1989 28:420-424.

[4]. Pringle M, Robins S, Brown G. TIMER: A New Objective Measure of Consultation Content and its Application to Computer Assisted Consultations. Brit. Med. J. 1986;293:20-22.

[5]. Robson J, et. al. Using Nurses for Preventive Activities With Computer Assisted Follow Up: A Randomized Trial. Brit. Med. J. 1989;298:433-436.

[6]. Gehlbach SH, Wilkinson WE, Clapp NE, Finn AL, et al: Improving Drug Prescribing in a Primary Care Practice. Med. Care 1984;22(3):193-201.

[7]. Dickinson JG, Warshaw GA, Gelbach SH, Bobula JA, et al: Improving Hypertension Control: Impact of Computer Feedback and Physician Education. Med. Care 1981;29(8):843-854.

[8]. McAlister MH, Covvey HD, Tong C, et al: Randomized Controlled Trial of Computer Assisted Management of Hypertension in Primary Care. Br. Med. J. 1986;293:670-674.

[9]. Rodnick JE, Computers and Family Practice. Tools of the Trade. Family Medicine 1988;20:16 and 68.

[10]. Bass M. et. al. Family/General Practice Data Standards Project: Process and Data Modelling Report. 1993 Publications Ontario. 70 Grosvenor St. Toronto.

[11]. Chisholm J. The Read Clinical Classification. Brit. Med. J. 1990;300(6732):1092.

[12]. Lindberg DAB, Humphreys. BL. The UMLS Knowledge Sources: Tools for Building Better User Interfaces. SCAMC Proceedings 1990;121-125.

[13]. Dambro MR, Weiss BD, McClure CL, et al. An Unsuccessful Experience with Computerized Records in an Academic Medical Center. J. Med. Educ. 1988;63:617-623.

[14]. Lamberts H, Wood M. eds. ICPC - International Classification of Primary Care. Oxford Medical Publications, Oxford University Press, 1987.

[15]. Burnham JF. Perspective: The Misinformation Era: The Fallout of the Medical Record. Ann Internal Med. 1989;110(6):482-484

[16]. Sackett DL. Clinical Disagreement: I. How Often it Occurs and Why. CMAJ 1980;123:499-504